**STREAM TABLE AND SOIL**

LAB REPORT – 70 pts.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Group #: \_\_\_\_\_\_\_\_

Period: \_\_\_\_\_\_\_\_

**OBJECTIVE:** To identify various features of streams and investigate a local soil sample.

**QUESTION:** Which house would survive a flood the longest – one built on the cut bank or point bar?

**HYPOTHESIS:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **(1 pt.)**

**MATERIALS:**

* Stream Table
* Sand
* Metric Ruler
* Calculator
* Sink
* Disposal Bucket
* Tubular Attachment
* Propping Objects
* 2 Miniature Houses
* Modeling Clay
* Plastic Spoon
* Stopwatch
* Balance
* Cheesecloth
* Clear Tube (open)
* Clear Tube (closed)
* Plastic Cup
* Plastic Container
* Graduated Cylinder
* Rubber Bands (2)
* Sand, 100 mL
* Soil, 100 mL
* Stopwatch
* Water
* Colored pencils
* 1 lab report sheet per student

**INTRODUCTION:**

When a river or stream winds back and forth, it develops bends known as **meanders**. Three factors affecting a stream’s ability to erode its channel include the **stream load**, or what the stream is carrying, **discharge**, the volume of water moved by a stream in a given period, and **gradient**, or the change in elevation of a stream over a given distance. Soil is an important natural resource. By providing both structure and nutrients foo plant growth, healthy soil ensures a bountiful and healthy food supply for life on Earth. The volume of air and water that soil can hold is known as the **porosity**, or soil pore size. The larger the soil particles, the more porosity the soil will have. The reverse is also true – the smaller the soil particle size, the less porosity the soil will have. The percent porosity of soil is measured using the following equation:

*Percent Porosity = (Pore Space Volume/Total Volume of Soil) x 100*

**Permeability** is the relative ease in which water and air can move through soil and is another key characteristic of soil. Soils that have high permeability can be pictured as being loose and soils with low permeability can be thought of as being tight or compacted.

**PROCEDURE:**

**Part 1 – Stream Tables**

1. Begin this lab by teaming up with the lab group next to yours. For example 🡪 Group 1 and 2 will work together, Group 3 and 4, Group 5 and 6, and Group 7 and 8.
2. Make sure your stream table is filled with sand leaving the bottom 10 cm. (the end with the drainage hole) empty for runoff. Level the sand to create a smooth all-around surface.
3. Using three propping objects (i.e. textbooks) to prop one end of your stream table (the end without the drainage hole) approximately 10-20 cm above the lab table. Align the end with the drainage hole along the edge of your lab station sink.
4. Place the disposal bucket directly beneath the drainage hole inside of the lab station sink and secure the tubular attachment to your faucet on your lab station sink.
5. Place the tube at the head of your stream, its starting point 🡪 the end propped in the air. Turn your faucet on very slowly and observe the small stream beginning to develop in the sand within your stream bed. Draw what you see in the diagram box below in full detail and color. **(2 pts.)**
6. Cut off the water flow to your stream by turning the faucet off. Smooth out your sand in your stream table so it once again has a smooth all-around surface. Again, make sure the bottom 15 cm. of your stream table is empty enabling runoff.
7. Using your plastic spoon, gently press into the sand within your stream table to create a winding, meandering stream channel.
8. Once you have created your meandering stream channel, you may now begin a slow water flow once again by turning your faucet on. Make sure your tube is at the head of the stream. Observe the water flowing through your created stream channel. Draw what you see in the diagram box below in full detail and color. **(2 pts.)**
9. Cut off the water flow once again by turning the faucet off. Now place one of your miniature houses right along the edge of a cut-bank and place the other miniature house right along the edge of a point-bar deposit. **(2 pts.)**
   1. Which one of your houses should get destroyed? Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Begin a slow, steady flow of water and at the same time, start your stopwatch. **(1 pt.)**

* 1. How much time did it take for a house to get destroyed? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Cut off your water flow once one of your houses gets flooded. **(1 pt.)**

* 1. What could you do to prevent this from happening in the future, perhaps during a potential flood? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Remove your miniature houses from your stream table and set them aside. You will need them at a later time. It is now time to flood your stream; however there will be NO HORSEPLAY during this portion of the lab 🡪 remember your participation points are at stake!
2. Start off by creating a slow, steady flow of water and gently increase the rate of flow. Once the water floods your stream and progresses onto the surrounding flood plain, immediately cut off the water flow and allow for everything to settle.
3. Observe the natural levees created along the shoulders of the stream from sediment deposits following the flood. Draw what you see in the diagram box below in full detail and color. **(2 pts.)**
4. Place your miniature houses back at their initial locations within your stream bed and using your modeling clay, create artificial levees to help prevent destruction during the next flood.
5. Begin a slow, steady flow of water to your stream and gently increase the rate of flow once again. Observe how the artificial clay levee is preventing water from reaching your house this time. Draw what you see in the diagram box below in full detail and color. **(2 pts.)**
6. Remove the miniature houses and all clay from your stream table. Using your plastic spoon, level off all sand in your stream table. It should now look like it did when you first arrived at your lab station. Remember to leave the bottom 15 cm. of your stream table empty for runoff. You may also remove any propping objects you used to elevate the stream table.

**Part 2 – Soil Observations**

1. Observe your local soil sample and carefully observe it – color, particle size, presence of insects, other plant materials. State your observations on the Soil Analysis Worksheet attached to this.
2. Sketch everything you see, in color, on the Soil Analysis Worksheet as well.

**Part 3 – Permeability**

1. Obtain a clear tube with two open ends.
2. Rubber-band a double piece of cheesecloth to one end of the tube.
3. Place the tube upright, with the cheesecloth end down, in a plastic cup.
4. Using a graduated cylinder, measure and place 40 mL of dry soil into the tube.
5. Hold the tube above the plastic cup and pour 25 mL of water into it. Use a stopwatch to time the drainage of the water. Start timing as soon as all of the water has been poured into the tube.
6. Stop timing when the water stops dripping from the bottom of the tube. You may want to tap the top a few times. To get an additional water droplets out of the sample. Record the elapsed time as the Drainage Time on the Soil Analysis Worksheet.
7. Divide the amount of water placed into the tube by the time required for drainage to determine the drainage rate (also known as the percolation rate) of the soil in mL per second. Record this value on the Soil Analysis Worksheet.
8. Pour the water from the cup into a sink. Save the tubes with the soil and the cups for the next part of the lab activity.
9. Place the tube with the wet soil in the cup once again.
10. Holding the tube above the cup, fill the tube again with 25 mL of water. Start timing as soon as all of the water has been poured into the tube.
11. Stop timing when the water stops dripping from the tube. Record drainage time for the first tube in seconds under Drainage Time on the Soil Analysis Worksheet.
12. Calculate and record the drainage rate for the wet soil on the Soil Analysis Worksheet.
13. Repeat steps 1-12 of Part 3 using sand in place of the local soil sample. Record all data in the Soil Analysis Worksheet.

**Part 4 – Porosity**

1. Obtain a tube with one closed end.
2. Using a graduated cylinder, measure out 100 mL of dry soil and place it in the tube.
3. Measure 100 mL of water into a graduated cylinder. This will be the initial amount of water.
4. Start a timer and slowly pour water from the graduated cylinder into the tube until the soil is saturated (water reaches the bottom of the soil).
5. Record the amount of time it takes the water to reach the bottom of the tube on the Soil Analysis Worksheet under Initial Time.
6. Record the amount of water remaining in the graduated cylinder on the Soil Analysis Worksheet.
7. Subtract the amount of water remaining in the graduated cylinder from the initial volume of water (100 mL). The difference is equal to the volume of pore spaces in the soil. Record the pore space volume on the Soils Analysis Worksheet.
8. Empty the graduated cylinder.
9. Pinch the tube and pour the water retained in the soil from the tube into the empty graduated cylinder. Be sure not to pour any of the soil into the graduated cylinder. Record this amount of water as water drained from the tube on the Soil Analysis Worksheet.
10. Subtract the water drained from the tube from the pore space volume of the sand. This value will be the volume of the water retained. Record this value on the Soil Analysis Worksheet.
11. Repeat steps 1-10 of Part 4 using sand in place of the local soil sample. Record all data on the Soil Analysis Worksheet.
12. Using the results from Part 4 and the equation from the Introduction, calculate the percent porosity of your local soil sample and sand sample. Record on the Soil Analysis Worksheet.

**LAB QUESTIONS (1 pt. each) –** *Please write your answers in* ***COMPLETE SENTENCES****!*

1. Explain where the water cycle gets its energy from to continuously drive the cycle.

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1. Is water vapor gaining or losing energy during evaporation?

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1. How much evaporation is from the oceans?

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1. What type of air can hold more water vapor, warm air or cold air?

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1. Explain entropy.

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1. Identify whether entropy is increasing or decreasing in the following scenarios:

Solid ice 🡪 liquid water: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Liquid water 🡪 water vapor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Water vapor 🡪 solid ice: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Name the five forms of precipitation.

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1. What is a watershed and name the largest one in the United States?

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1. Describe the two main parts of a stream channel.

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1. Differentiate between the head and mouth of a stream. Identify the head and mouth of the Mississippi River.

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1. Describe how stream piracy can occur.

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1. Explain the process of identifying stream order.

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1. Name the three factors influencing a stream’s ability to erode its channel.

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1. Explain the different forms a stream’s load can exhibit.

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1. What are the stages of a river’s life? Who developed a model showing this development?

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1. Describe meanders.

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1. Differentiate between cut banks and point bars.

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1. What happens to the velocity of a stream as it begins to meander?

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1. Explain in detail how oxbow lakes are formed.

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1. Define terraces and identify in which stage of river development they are most common.

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1. What is the benefit of soil with high moisture levels? What about possible drawbacks?

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1. What percentage of the Earth is covered in water?

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1. What percentage of the water on Earth is contained within the oceans?

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1. Compare and contrast porosity and permeability.

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1. The water table is separated by what two zones underground?

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**CONCLUSION (5 pts.) –** *Write a solid paragraph (at least 5 sentences) about your conclusions from the lab. Discuss the steps you went through during your lab experiment, what you accomplished, and how you tested your hypothesis. Also include what you learned as a result of this lab experiment.*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**SOIL ANALYSIS WORKSHEET**

**(27 pts.)**

**Soil Observations and Sketches**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Permeability**

*Dry Sample Drainage*

|  |  |  |
| --- | --- | --- |
| **Sample** | **Drainage Time (s)** | **Drainage Rate (mL/s)** |
| Soil |  |  |
| Sand |  |  |

*Wet Sample Drainage*

|  |  |  |
| --- | --- | --- |
| **Sample** | **Drainage Time (s)** | **Drainage Rate (mL/s)** |
| Soil |  |  |
| Sand |  |  |

**Porosity**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample** | **Time (s)** | **Amount of Water Remaining in Graduated Cylinder (mL)** | **Pore Space Volume (mL)** | **Water Drained from Tube (mL)** | **Water Retained (mL)** |
| Soil |  |  |  |  |  |
| Sand |  |  |  |  |  |

*Show all work below for the Percent Porosity Calculations.*

**Soil** % Porosity = \_\_\_\_\_\_\_\_\_ **Sand** % Porosity = \_\_\_\_\_\_\_\_\_